Item #	Rationale	
1	Option A is correct	To determine the function that represents the relationship shown in the table, the student could have used the slope-intercept form of a linear equation (*y* = *mx* + *b,* where $m = \frac{y_2 - y_1}{x_2 - x_1}$ represents the slope of the line and *b* represents the value of the *y*-intercept). The student first could have substituted the *x*- and *y*-coordinates of (–4, 10) and (–2, 7) into the slope formula, resulting in $m = \frac{7-10}{-2-(-4)} = -\frac{3}{2}$. Next, the student could have substituted the *x*- and *y*-coordinates of (6, –5) and the slope, $m = -\frac{3}{2}$, into *y* = *mx* + *b* and solved for *b*: $-5 = -\frac{3}{2}(6) + b$, or *b* = 4. Since $m = -\frac{3}{2}, y = -\frac{3}{2}x + 4$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely determined the slope of the line correctly but subtracted 9 instead of adding when solving for *b*. The student needs to focus on understanding how to write a linear function in slope-intercept form when given a table.
	Option C is incorrect	The student likely used the change in *x* divided by the change in *y* to find the slope of the line and subtracted 4 instead of adding when solving for *b*. The student needs to focus on understanding how to write a linear function in slope-intercept form when given a table.
	Option D is incorrect	The student likely used the change in *x* divided by the change in *y* to find the slope of the line and correctly used the point (6, –5) to find the value of *b*. The student needs to focus on understanding how to write a linear function in slope-intercept form when given a table.

Item #	Rationale	
2	decreases, 0.25	To complete the statement that describes the rate of change (constant rate of increase or decrease) of the water level with respect to time, the student could have chosen two points from the graph and calculated the amount of change. The student could have used the ordered pairs (0, 9) and (4, 8) and applied the slope formula, $m = \frac{y_2-y_1}{x_2-x_1}$, resulting in $m = \frac{8-9}{4-0} = -\frac{1}{4} = -0.25$. Since the rate of change is negative, this indicates that the water level is decreasing at a rate of 0.25 meter per hour. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
3	Option A is correct	To determine the function that best represents the graph, the student could have identified the solutions (x-values when y is equal to zero) of the function as u and v and used the solutions to construct and simplify the equation of a quadratic function using $h(x) = a(x - u)(x - v)$, where a, u, and v represent values. The solutions can be identified as the x-values where the parabola (U-shaped graph) crosses the x-axis (at $x = -3$ and $x = 1$). Letting $u = -3$ and $v = 1$, the student could have substituted those values into the equation $h(x) = a(x - u)(x - v)$, resulting in $h(x) = a[x - (-3)](x - 1) \rightarrow h(x) = a(x + 3)(x - 1)$. The student could have then multiplied the expressions $(x + 3)$ and $(x - 1)$, resulting in $h(x) = a(x^2 - x + 3x - 3) \rightarrow h(x) = a(x^2 + 2x - 3)$. Next, the student could have solved for a by substituting the coordinates of the vertex (high or low point of the curve), $(-1, -4)$, into the function $h(x) = a(x^2 + 2x - 3)$, resulting in $-4 = a((-1)^2 + 2(-1) - 3) \rightarrow -4 = a(1 - 2 - 3) \rightarrow -4 = -4a \rightarrow a = 1$. The student could have then substituted the value of a into the function $h(x) = a(x^2 + 2x - 3)$, resulting in $h(x) = 1(x^2 + 2x - 3) \rightarrow h(x) = x^2 + 2x - 3$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely made a sign error when substituting $u = -3$ and $v = 1$ into the equation $h(x) = a(x - u)(x - v)$, resulting in $h(x) = a(x - 3)(x + 1)$. The student needs to focus on understanding how to identify the solutions of a quadratic function and write the equation of the function using those solutions.
	Option C is incorrect	The student likely made a sign error when substituting $u = -3$ and $v = 1$ into the equation $h(x) = a(x - u)(x - v)$, resulting in $h(x) = a(x + 3)(x + 1)$. The student needs to focus on understanding how to identify the solutions of a quadratic function and write the equation of the function using those solutions.
	Option D is incorrect	The student likely made a sign error when substituting $u = -3$ and $v = 1$ into the equation $h(x) = a(x - u)(x - v)$, resulting in $h(x) = a(x - 3)(x - 1)$. The student needs to focus on understanding how to identify the solutions of a quadratic function and write the equation of the function using those solutions.

Item #	Rationale	
4	Option D is correct	To determine the value of x, the student could have modeled the equation by using the formula for the area of a rectangle ($A = bh$ where A is the area of the rectangle, b is the length of the base of the rectangle, and h is the height of the rectangle) and the formula for the area of a triangle ($A = \frac{1}{2}bh$, where A is the area of the triangle, b is the length of the base of the triangle, and h is the height of the rectangle) to find the expressions on either side of the equation. Substituting $b = 5 + 2x$ and $h = 10$ into the formula for the area of a rectangle, the student should obtain $(5 + 2x)(10)$ or $50 + 20x$. Substituting $b = 30$ and $h = 4x – 10$ into the formula for the area of triangle, the student should obtain $\frac{1}{2}(30)(4x - 10)$ or $60x – 150$. Next, the student should have set the two expressions equal one another since the area of the rectangle is equal to the area of the triangle, resulting in $50 + 20x = 60x – 150$. The student could have then subtracted $20x$ from both sides of the equation, resulting in $50 = 40x – 150$, and then added 150 to both sides, resulting in $200 = 40x$. Finally, the student could have divided both sides of the equation by 40, resulting in $5 = x$, or $x = 5$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely subtracted 50 from 150 on the left side of the equation instead of adding 150, resulting in $100 = 40x$. Dividing by 40 on both sides, the student likely concluded that $x = 2.5$. The student needs to focus on understanding the arithmetic of solving equations.
	Option B is incorrect	The student likely used the incorrect formula for the area of a triangle, resulting in $10(5 + 2x) = 2(30)(4x – 10) \rightarrow 10(5 + 2x) = 60(4x – 10)$. Next, the student likely distributed (multiplied) the number in front of the parentheses to the terms inside the parentheses, resulting in $50 + 20x = 240x – 600$. After subtracting $20x$ from both sides and adding 600 to both sides, the student likely obtained the equation $650 = 220x$. Dividing by 220 on both sides, the student likely concluded that $x \approx 2.95$, which is close to $x = 3$. The student needs to focus on understanding the arithmetic of solving equations.
	Option C is incorrect	The student likely set the two given expressions equal, resulting in $5 + 2x = 4x – 10$. After subtracting $2x$ from both sides and adding 10 to both sides, the student likely obtained the equation $15 = 2x$. Dividing by 2 on both sides, the student likely concluded that $x = 7.5$. The student needs to focus on understanding the arithmetic of solving equations.

Item #	Rationale	
5	Option C is correct	To determine a factor of the given expression, $30x^2 - 4x - 16$, the student could have found the factors (numbers or expressions that can be multiplied to get another number or expression) of the expression. The student could have first factored out the greatest common factor (largest factor that divides evenly into all the terms) from each term, resulting in $2(15x^2 - 2x - 8)$. Next, the student could have multiplied $15x^2$ by –8, resulting in $-120x^2$. The student then could have identified two terms that have a product of $-120x^2$ and a sum of $-2x$, which are $-12x$ and $10x$. Then the student could have rewritten the expression in expanded form using these two terms, resulting in $2(15x^2 - 12x + 10x - 8)$. The student could have grouped the first two terms and last two terms of the expression and factored out the greatest common factor (largest factor that divides evenly into all the terms) from each group of terms, resulting in $2[3x(5x - 4) + 2(5x - 4)]$. Next, the student could have factored out the binomial $(5x - 4)$ from the expression, resulting in the factored form $2(5x - 4)(3x + 2)$. Finally, the student could have recognized that $(5x - 4)$ is one of the factors of the given expression. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely determined that two factors of $15x^2$ are $5x$ and $3x$ and that two factors of –8 are 4 and –2 but disregarded the value of the linear term of the quadratic expression, resulting in $2(5x + 4)(3x - 2)$. The student needs to focus on understanding how to factor an expression of the form $ax^2 + bx + c$.
	Option B is incorrect	The student likely determined that two factors of $15x^2$ are $5x$ and $3x$ and that two factors of –8 are 4 and –2 but disregarded the value of the linear term of the quadratic expression, resulting in $2(5x + 4)(3x - 2)$. The student needs to focus on understanding how to factor an expression of the form $ax^2 + bx + c$.
	Option D is incorrect	The student likely determined that two factors of $15x^2$ are $5x$ and $3x$ and that two factors of –8 are 2 and –4 but disregarded the value of the linear term of the quadratic expression, resulting in $2(5x + 2)(3x - 4)$. The student needs to focus on understanding how to factor an expression of the form $ax^2 + bx + c$.

Item #	Rationale	
6	Option B is correct	To determine the correlation (measure of strength of a relationship between two variables), the student should have determined the correlation coefficient (a value represented by *r* that measures the strength of a linear association) using the linear regression feature on a graphing calculator. The correlation coefficient that best models this data is $r \approx -0.09$. Since the correlation coefficient is negative and close to zero, the linear association is a weak negative correlation.
	Option A is incorrect	The student likely interpreted the strength of the linear association correctly but identified $-(1 + r)$ as the correlation coefficient. The student needs to focus on understanding how to determine the correlation coefficient between two quantitative variables and how to interpret this quantity as a measure of the strength of the linear association.
	Option C is incorrect	The student likely identified $-(1 + r)$ as the correlation coefficient. The student needs to focus on understanding how to determine the correlation coefficient between two quantitative variables and how to interpret this quantity as a measure of the strength of the linear association.
	Option D is incorrect	The student likely identified the correlation coefficient but interpreted a correlation coefficient close to zero as representing a strong negative correlation. The student needs to focus on understanding how to determine the correlation coefficient between two quantitative variables and how to interpret this quantity as a measure of the strength of the linear association.

Item #	Rationale	
7	greater than –4, less than or equal to 2	To determine the range (all possible *y*-values) of the part of the linear function shown, the student could have identified all the values of *y* for which the graph has an *x*-value. The graph extends from –4 at its lowest point to 2 at its highest point and includes *y* = 2 and all *y*-values between *y* = –4 and *y* = 2. Therefore, the range is all real numbers greater than –4 and less than or equal to 2. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
8	Option D is correct	To determine which statement is true, the student could have first found the factors (numbers or expressions that can be multiplied to get another number or expression) of $4x^2 - 36x + 81$. The student could have recognized that $4x^2$ and 81 represent perfect squares (numbers made by squaring whole numbers). Using this, the student could have also noticed that the square root of $4x^2$ is $2x$ and the square root of 81 is 9. Multiplying the two square roots gives $2x \bullet 9 = 18x$. Since $36x$ is twice $18x$, the student could have correctly realized that $4x^2 - 36x + 81$ has the form of a perfect square trinomial $a^2 - 2ab + b^2$, which factors as $(a - b)^2$. In this case, $a = 2x$ and $b = 9$, so that the factored form of the function can be written as $(2x - 9)^2$. Finally, the student could have solved for the zero (input value, x, that produces an output value, y, of zero) by setting the factor equal to zero and solving for x, resulting in $2x - 9 = 0$ or $x = \frac{9}{2}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely determined that two factors of $4x^2$ are $4x$ and x and that two factors of 81 are –3 and –27 but disregarded the value of the linear term of the quadratic equation, resulting in $(4x - 3)(x - 27)$. The student needs to focus on understanding how to factor an expression representing a perfect square trinomial.
	Option Bis incorrect	The student likely determined that two factors of $4x^2$ are $2x$ and $2x$ and that two factors of 81 are 3 and 27 but disregarded the value of the linear term of the quadratic equation, resulting in $(2x + 3)(2x + 27)$. The student needs to focus on understanding how to factor an expression representing a perfect square trinomial.
	Option C is incorrect	The student likely incorrectly identified the perfect square trinomial pattern as a difference of squares, resulting in $(2x - 9)(2x + 9)$. The student needs to focus on understanding how to factor an expression representing a perfect square trinomial.

Item #	Rationale	
9	*y*, 0 or 0, *y*	To determine the equation of the asymptote (a line that a curve approaches), the student could have used a graphing calculator to generate the graph of $y = 16(0.75)^x$. Since the graph is an exponential curve that extends forever to the left and the right and never crosses the x-axis (horizontal axis), the equation of the asymptote of the graph is $y = 0$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
10	Option C is correct	To determine the equivalent expression, the student could have applied the power of a power property ($(a^m)^n = a^{mn}$), resulting in $x^{\frac{3}{7}\cdot 2}$, or $x^{\frac{6}{7}}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student multiplied both the numerator (top number in a fraction) and the denominator (bottom number in a fraction) of the exponent (power that a number is raised to) by 2, resulting in $x^{\frac{3\cdot 2}{7\cdot 2}}$, or $x^{\frac{6}{14}}$. The student needs to focus on understanding how to use the properties of exponents to simplify expressions with a power raised to a power.
	Option B is incorrect	The student added instead of multiplying the exponents, resulting in $x^{\frac{3}{7}+2}$, or $x^{\frac{17}{7}}$. The student needs to focus on understanding how to use the properties of exponents to simplify expressions with a power raised to a power.
	Option D is incorrect	The student likely added the numerator (top number in a fraction) of the exponent to the power of 2, resulting in $x^{\frac{3+2}{7}}$, or $x^{\frac{5}{7}}$. The student needs to focus on understanding how to use the properties of exponents to simplify expressions with a power raised to a power.

Item #	Rationale	
11	Option B is correct	To determine which statement is true, the student could have graphed the quadratic function and analyzed the parabola (U-shaped graph). To identify the domain (all possible *x*-values) of the function, the student could have identified all the *x*-values for which the graph has a *y*-value. The student could have determined that the graph continues to expand upward and outward indefinitely, making the domain all real numbers. To identify the range (all possible *y*-values) of the function, the student could have identified all the *y*-values for which the graph has an *x*-value. The student could have identified- the *y*-coordinate of the graph's lowest point, (2, –8), and all the *y*-values greater than that *y*-coordinate, which means that the range is all values greater than or equal to –8, or $n(x) \geq -8$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified the domain of the function as the *x*-coordinate of the graph's lowest point and all the *x*-values greater than that *x*-coordinate, resulting in all values greater than or equal to 2, or $x \geq 2$. The student needs to focus on understanding how to represent the domain of a quadratic function.
	Option C is incorrect	The student likely identified the domain of the function as the positive *x*-values, resulting in all values greater than or equal to 0, or $x \geq 0$. The student needs to focus on understanding how to represent the domain of a quadratic function.
	Option D is incorrect	The student likely identified the range of the function as the *y*-coordinate of the graph's *y*-intercept and all the *y*-values less than that *y*-coordinate, resulting in all values less than or equal to 12, or $n(x) \leq 12$. The student needs to focus on understanding how to represent the range of a quadratic function.

Item #	Rationale	
12	7, 10, >, 100	To determine the inequality that represents all possible combinations of hats, x, and T-shirts, y, in an order that qualifies for free shipping, the student should have first identified that each hat costs \$7 and each T-shirt costs \$10 and represented those costs by the expressions $7x$ and $10y$. The total cost of the hats and T-shirts in an order should be represented by the expression $7x + 10y$. Then the student should have realized that the phrase “is over” can be represented by the inequality symbol “>”, so the phrase “is over \$100” can be represented by “ > 100”. Therefore, all possible combinations of x and y in an order that qualifies for free shipping should be represented by the inequality $7x + 10y > 100$.

Item #	Rationale	
13	Option A is correct	To determine the best estimate for the miles per gallon when the speed is 65 miles per hour, the student could have first used a graphing calculator to generate the function using quadratic regression (a method of determining a quadratic function, $y = ax^2 + bx + c$, where *a, b,* and *c* are real numbers). The quadratic function that best models the data is $y = –0.00734x^2 + 0.689x + 14.115$. Next, the student could have substituted 65 for *x* in the function and solved for *y*, resulting in $y = –0.00734(65)^2 + 0.689(65) + 14.115 = 27.8885$. Therefore, 27.9 represents the best estimate for the miles per gallon when the speed is 65 miles per hour. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely generated the function using a linear regression (a method of determining a linear function, $y = mx + b$, where *m* represents the slope of the linear function and *b* represents the *y*-intercept), resulting in $y = 0.096x + 24.807$. Next, the student likely substituted 65 for *x* in the function and solved for *y*, resulting in $y = 0.096(65) + 24.807 = 31.047$. The student needs to focus on understanding how to write a quadratic function that was generated using quadratic regression.
	Option C is incorrect	The student likely generated the function using a linear regression using only the first two ordered pairs in the table, resulting in $y = 0.34x + 18.1$. Next, the student likely substituted 65 for *x* in the function and solved for *y*, resulting in $y = 0.34(65) + 18.1 = 40.2$. The student needs to focus on understanding how to write a quadratic function that was generated using quadratic regression.
	Option D is incorrect	The student likely interpreted the point (40, 30.1) as the vertex (high or low point of the curve) and chose the first *y*-value in the table. The student needs to focus on understanding how to write a quadratic function that was generated using quadratic regression.

Item #	Rationale	
14	Option A is correct	To determine which exponential function models the given values, the student could have recognized that an exponential function is of the form $p(x) = ab^x$, where a is the initial value (starting value), b is the common factor (constant rate by which successive values increase or decrease), and x is the variable (symbol used to represent an unknown number). From the information given, the student could have determined that the initial population of the town was 48,000, resulting in $a = 48{,}000$. Next, the student could have determined the common factor, b, by dividing the population of the town after one year by the initial population, resulting in $b = \frac{50{,}400}{48{,}000}$. Substituting $a = 48{,}000$ and $b = \frac{50{,}400}{48{,}000}$ into the exponential function $p(x) = ab^x$, the student could have obtained $p(x) = 48{,}000\left(\frac{50{,}400}{48{,}000}\right)^x$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely correctly determined the value of b as $\frac{50{,}400}{48{,}000}$. When determining the initial value, a, the student likely used the value of $p(x)$ when $x = 1$ instead of when $x = 0$, resulting in $a = 50{,}400$. The student needs to focus on understanding how to determine the initial value of an exponential function from the given information.
	Option C is incorrect	The student likely identified the initial value as the value of $p(x)$ when $x = 1$ instead of when $x = 0$, resulting in $a = 50{,}400$. Then the student likely divided 1 by the population of the town when $x = 0$ to determine the common factor, resulting in $b = \frac{1}{48{,}000}$. The student needs to focus on understanding how to determine the initial value and common factor of an exponential function from the given information.
	Option D is incorrect	The student likely correctly determined that the value of a is 48,000. When determining the value of the common factor, b, the student likely divided 1 by the population of the town after one year, resulting in $b = \frac{1}{50{,}400}$. The student needs to focus on understanding how to determine the common factor of an exponential function from the given information.

Item #	Rationale	
15	Option D is correct	To determine which graph represents functions *f* and *g*, the student should have compared the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) and *y*-intercept (value where a line crosses the *y*-axis) of both lines on the grid. The graph of function *f* increases at a rate of 1 (each time the *x*-value increases by 1 unit, the *y*-value also increases by 1 unit) and has a *y*-intercept of 0. The graph of function *g* increases at a rate of 3 (each time the *x*-value increases by 1 unit, the *y*-value increases by 3 units) and has a *y*-intercept of 0. The difference between the two graphs is that the graph of function *g* is increasing 3 times as fast as the graph of function *f*. This relationship is best represented by the graph where each *y*-value of function *g* is 3 times the *y*-value of function *f* for the same *x*-value. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified the graph of a function *g* that has a slope of 1 instead of 3 and a *y*-intercept of –3 instead of 0. The student needs to focus on understanding how transformations affect the slope and *y*-intercept of the graph of a line.
	Option B is incorrect	The student likely identified the graph of a function *g* that has a slope of 1 instead of 3 and a *y*-intercept of 3 instead of 0. The student needs to focus on understanding how transformations affect the slope and *y*-intercept of the graph of a line.
	Option C is incorrect	The student likely identified the graph of a function *g* that has a slope of $\frac{1}{3}$ instead of 3 and a *y*-intercept of 0. The student needs to focus on understanding how transformations affect the slope and *y*-intercept of the graph of a line.

Item #	Rationale	
16	Option B is correct	To determine the quotient (answer when divided) represented by the expression, the student could have eliminated the factors (numbers or expressions that can be multiplied to get another number or expression) in the numerator (top number in a fraction) that are in common with factors in the denominator (bottom number or expression in a fraction). To determine the factors of the numerator, $8w^2 - 20w - 12$, the student could have first factored out the greatest common factor (largest factor that can be divided evenly into all the terms) from each term, resulting in $4(2w^2 - 5w - 3)$. Next, the student could have multiplied $2w^2$ by -3, resulting in $-6w^2$. The student then could have identified two terms that have a product (answer when multiplied) of $-6w^2$ and a sum (answer when added) of $-5w$, which are w and $-6w$. Then the student could have rewritten the expression in expanded form using these two terms, resulting in $4(2w^2 - 6w + w - 3)$. The student could have grouped the first two terms and last two terms of the expression and factored out the greatest common factor from each group of terms, resulting in $4[2w(w - 3) + 1(w - 3)]$. Next, the student could have factored out the binomial $(w - 3)$ from the expression, resulting in the factored form $4(w - 3)(2w + 1)$. Finally, the student could have recognized that $(2w + 1)$ is a factor that the numerator and denominator have in common and eliminated that factor from both expressions, resulting in $4(w - 3)$, or $4w - 12$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely determined that two factors of $8w^2$ are $4w$ and $2w$ and that two factors of -12 are 12 and 1, but disregarded the value of the linear term of the quadratic equation, resulting in $(4w + 12)(2w + 1)$. Then the student likely recognized that $(2w + 1)$ is a factor that the numerator and denominator have in common and eliminated that factor from both expressions, resulting in $4w + 12$. The student needs to focus on understanding how to determine the quotient of a polynomial of degree two divided by a polynomial of degree one.
	Option B is incorrect	The student likely removed the greatest common factor from the numerator before finding the quotient, resulting in $\frac{2w^2-5w-3}{2w+1}$ or $\frac{(2w+1)(w-3)}{2w+1}$. Then the student likely recognized that $(2w + 1)$ is a factor that the numerator and denominator have in common and eliminated that factor from both expressions, resulting in $w - 3$. The student needs to focus on understanding how to determine the quotient of a polynomial of degree two divided by a polynomial of degree one.
	Option D is incorrect	The student likely removed the greatest common factor from the numerator before finding the quotient, resulting in $\frac{2w^2-5w-3}{2w+1}$. Then, the student likely determined that two factors of $2w^2$ are $2w$ and w, and that two factors of -3 are 3 and 1, but disregarded the value of the linear term of the quadratic equation, resulting in $(2w + 1)(w + 3)$. Then, the student likely recognized that $(2w + 1)$ is a factor that the numerator and denominator have in common and eliminated that factor from both

		expressions, resulting in $w + 3$. The student needs to focus on understanding how to determine the quotient of a polynomial of degree two divided by a polynomial of degree one.

Item #	Rationale	
17	Option A is correct	To determine which ordered pair is in the solution set of $y \leq \frac{3}{5}x - 6$, the student should have recognized that the "≤" symbol indicates that the solution set of the inequality includes the points on the boundary line. Next, the student could have used the test point (5, –4) to determine which half-plane is included in the solution set. Substituting (5, –4) into $y \leq \frac{3}{5}x - 6$, the student could have obtained $-4 \leq \frac{3}{5}(5) - 6$, which simplifies to –4 ≤ –3. Since that is a true statement, the student could have concluded that the solution set of the inequality is the half-plane that contains (5, –4). This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely interpreted the "≤" symbol in the inequality as meaning "greater than or equal to" and identified an ordered pair in that solution set. The student needs to focus on understanding the meaning of the inequality symbol.
	Option C is incorrect	The student likely used the point with coordinates of (9, –1) instead of (9, 1) as a test point and substituted it into $y \leq \frac{3}{5}x - 6$, resulting in $-1 \leq \frac{3}{5}(9) - 6$, which simplifies to –1 ≤ –0.6. Next, the student likely concluded that the solution set of the inequality is the half-plane that contains that point. The student needs to focus on understanding how to determine whether an ordered pair is in the solution set of an inequality.
	Option D is incorrect	The student likely reversed the coordinates of (–8, 3) when using it as a test point and substituted it into $y \leq \frac{3}{5}x - 6$, resulting in $-8 \leq \frac{3}{5}(3) - 6$, which simplifies to –8 ≤ –4.2. Next, the student likely concluded that the solution set of the inequality is the half-plane that contains that point. The student needs to focus on understanding how to determine whether an ordered pair is in the solution set of an inequality.

Item #	Rationale	
18	Option B is correct	To determine which statement is true, the student could have used a graphing calculator to generate the graph of $p(x) = -7(4)^x$. Since the graph is an exponential curve that extends infinitely to the left and the right, the domain (all possible x-values) is all real numbers. No matter which x-value is chosen, its corresponding y-value is negative; therefore, the range (all possible y-values) is all real numbers less than 0. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified the base (value of b in an exponential function in the form of $p(x) = ab^x$) of the exponential function, $b = 4$, as representing the lower boundary of the domain of the function. The student needs to focus on understanding how to identify and express the domain and range of a function.
	Option C is incorrect	The student likely identified the set of values of the range as the domain and included zero. The student needs to focus on understanding how to identify and express the domain and range of a function.
	Option D is incorrect	The student likely identified the set of values of the domain as the range. The student needs to focus on understanding how to identify and express the domain and range of a function.

Item #	Rationale	
19	Option D is correct	To determine which statement is true, the student could have analyzed the parabola (U-shaped graph) graphed on the grid. The student could have recognized that the graph of the function has exactly two x-intercepts (points where the curve touches the x-axis [horizontal axis]), which are located at (–1, 0) and (3, 0). The student then should have concluded that the zeros (input value, x, that produces an output value, y, of zero) of the function are $x = -1$ and $x = 3$. The student could have also recognized that the vertex (high or low point of the curve) of the graph is located at (1, 4) and that the graph is facing downward; thus, the maximum value of the function is 4. Next, the student could have recognized that the axis of symmetry (an imaginary vertical line that goes through the vertex of a parabola) is represented by the equation $x = n$, where n represents the x-coordinate of the vertex. Therefore, the equation of the axis of symmetry of the graph of the function is $x = 1$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely counted the y-intercept (value where a graph crosses the y-axis) as a zero of the function. The student needs to focus on understanding how to identify the key features of a quadratic function when given a graph of the function.
	Option B is incorrect	The student likely used the greatest value of the x-intercept (value where a graph crosses the x-axis), $x = 3$, as the maximum value of the function. The student needs to focus on understanding how to identify the key features of a quadratic function when given a graph of the function.
	Option C is incorrect	The student likely switched the coordinates in the vertex of the graph of the function, resulting in (4, 1). The student needs to focus on understanding how to identify the key features of a quadratic function when given a graph of the function.

Item #	Rationale	
20	Option B is correct	To determine the equivalent expression, the student could have rewritten $\sqrt{600}$ as $\sqrt{100 \cdot 6}$ and then calculated the square root (a value that when multiplied by itself is equal to the number under the $\sqrt{}$) of 100, to get $10 \cdot \sqrt{6}$, or $10\sqrt{6}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely reversed the placement of the values after calculating the square root, resulting in $6\sqrt{10}$. The student needs to focus on understanding how to simplify square roots.
	Option C is incorrect	The student likely rewrote 600 as 25 • 24 and then used the 24 from under the radical as the coefficient. The student needs to focus on understanding how to simplify square roots.
	Option D is incorrect	The student likely rewrote 600 as 25 • 24 and then used the 25 from under the radical as the coefficient. The student needs to focus on understanding how to simplify square roots.

Item #	Rationale	
21	Option A is correct	To determine which statement is true, the student could have recognized that the equation of a vertical line can be written as *x* = *a*, where *a* is the value where the line intersects (crosses) the *x*-axis (horizontal axis). Therefore, the equation of the line is *x* = –4. To determine the slope (steepness of a straight line when graphed on a coordinate grid, represented by $m = \frac{y_2 - y_1}{x_2 - x_1}$), the student should have chosen two points on the line and substituted the corresponding values in the equation for the slope of a line. Using (–4, 0) and (–4, 2), $m = \frac{2-0}{-4-(-4)} = \frac{2}{0}$, which is “undefined” because division by zero is not possible. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely used the variable (symbol used to represent an unknown number) *y* for the equation because the line is parallel to the *y*-axis (vertical axis), and then used the *x*-value of –4 as the slope. The student needs to focus on understanding how to write the equation of a vertical line and on understanding that the slope of all vertical lines is undefined.
	Option C is incorrect	The student likely used the correct variable, *x,* for the equation because the line is perpendicular to the *x*-axis, but used the *x*-value of –4 as the slope. The student needs to focus on understanding that the slope of all vertical lines is undefined.
	Option D is incorrect	The student likely found the correct slope of the line but used the variable *y* for the equation because the line is parallel to the *y*-axis. The student needs to focus on understanding how to write the equation of a vertical line.

Item #	Rationale	
22	Option C is correct	To determine the zero (input value, *x*, that produces an output value, *y*, of zero) of linear function *f*, the student could have identified the *x*-value where the line crosses the *x*-axis (horizontal axis), which is 2. Therefore, the zero of *f* is 2. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely interpreted the zero of the function as representing the opposite value of the slope (steepness of a straight line when graphed on a coordinate grid, represented by $m = \frac{y_2 - y_1}{x_2 - x_1}$), which is –3. The student needs to focus on understanding how to identify key features of linear functions.
	Option B is incorrect	The student likely interpreted the zero of the function as representing the slope, which is 3. The student needs to focus on understanding how to identify key features of linear functions.
	Option D is incorrect	The student likely interpreted the zero of the function as representing the *y*-value where the line crosses the *y*-axis (vertical axis), which is –6. The student needs to focus on understanding how to identify key features of linear functions.

Item #	Rationale	
23	Option B is correct	To determine the solution to the system of linear equations, the student could have used the elimination method. Multiplying the first equation by 2 results in the equation $-6x + 10y = 42$. The student could have added this to the second equation, $6x - y = -15$, to get the result $9y = 27$. The student then could have divided both sides of the resulting equation by 9, obtaining $y = 3$. Next, to find the corresponding value of x, the student could have substituted $y = 3$ into the second equation, resulting in $6x - 3 = -15$. Adding 3 to both sides of that equation results in $6x = -12$. Finally, the student could have divided both sides of the equation by 6, resulting in $x = -2$. Since $x = -2$ and $y = 3$, the ordered pair that is a solution to the system of equations is $(-2, 3)$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely multiplied the second equation by 5, obtaining $30x - 5y = -75$ but made a sign error when adding to the first equation, resulting in $-27x = -54$. The student then likely divided both sides of the resulting equation by -27, obtaining $x = 2$. Next, the student likely substituted $x = 2$ into the second equation of the system, resulting in $6(2) - y = -15$ or $12 - y = -15$. Subtracting 12 from both sides of the equation results in $-y = -27$. Finally, the student likely divided both sides of the equation by -1, resulting in $y = 27$. Since $x = 2$ and $y = 27$, the student likely determined that the solution to the system of equations is $(2, 27)$. The student needs to focus on understanding how to complete all the steps to calculate the solution to a system of equations.
	Option C is incorrect	The student likely used the elimination method incorrectly by adding the two equations without eliminating a variable, resulting in $3x + 4y = 6$. The student likely then recognized that $(2, 0)$ is a solution to the resulting equation, since $3(2) + 4(0) = 6$. The student needs to focus on understanding how to complete all the steps to calculate the solution to a system of equations.
	Option D is incorrect	The student likely multiplied the first equation by 2, obtaining $-6x + 10y = 42$, but made a sign error when adding to the second equation, resulting in $-9y = 27$. The student then likely divided both sides of the resulting equation by -9, obtaining $y = -3$. Next, the student likely substituted $y = -3$ into the second equation, resulting in $6x + 3 = -15$. Subtracting 3 from both sides of the equation results in $6x = -18$. Finally, the student likely divided both sides of the equation by 6, resulting in $x = -3$. Since $x = -3$ and $y = -3$, the student determined that the solution to the system of equations is $(-3, -3)$. The student needs to focus on understanding how to complete all the steps to calculate the solution to a system of equations.

Item #	Rationale	
24	Option A is correct	To determine which expressions are equivalent to $12x^2 – 48x + 48$, the student could have found the factors (numbers or expressions that can be multiplied to get another number or expression) of the expression. The student could have first factored out the greatest common factor (largest factor that divides evenly into all the terms), 12, from each term, resulting in $12(x^2 – 4x + 4)$. Next, the student could have recognized that x^2 is equal to x times x and written x as the first term in each factor. The student could then have determined that the second terms in the factors are –2 and –2 because their product (answer when multiplied) is 4 and their sum (answer when added) is –4. The student could have then written the factors as $12(x – 2)(x – 2)$, or $12(x – 2)^2$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option E is correct	To determine which expressions are equivalent to $12x^2 – 48x + 48$, the student could have found the factors of the expression. The student could have first factored out the greatest common factor, 12, from each term, resulting in $12(x^2 – 4x + 4)$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely made a sign error when factoring out the greatest common factor from each term, resulting in $–12(x^2 + 4x + 4)$. The student needs to focus on understanding how to factor an expression of the form $ax^2 + bx + c$.
	Option C is incorrect	The student likely determined that two factors of x^2 are x and x and that two factors of 4 are –4 and –1 but disregarded the value of the linear term of the quadratic equation, resulting in $12(x – 4)(x – 1)$. The student needs to focus on understanding how to factor an expression of the form $ax^2 + bx + c$.
	Option D is incorrect	The student likely made a sign error when factoring out the greatest common factor from each term, resulting in $–12(x^2 + 4x + 4)$. Next, the student likely determined that the first term in each factor is x and that the second term in each factor is 2, resulting in $–12(x + 2)(x + 2)$, or $–12(x + 2)^2$. The student needs to focus on understanding how to factor an expression of the form $ax^2 + bx + c$.

Item #	Rationale	
25	Option D is correct	To determine the quadratic function in vertex form ($y = a(x - h)^2 + k$, where (h, k) is the vertex [high or low point of the curve] and a is the coefficient of the quadratic term), the student could have identified the vertex of the function as (h, k) and used the additional given point to create the equation of the quadratic function. Letting $h = 1$ and $k = 46$, the student could have substituted those values into the function $y = a(x - h)^2 + k$, resulting in $y = a(x - 1)^2 + 46$. Next, the student could have solved for a by substituting the coordinates of the additional point, (3, 10), into the function $y = a(x - 1)^2 + 46$, resulting in $10 = a(3 - 1)^2 + 46 \rightarrow 10 = 4a + 46 \rightarrow -36 = 4a \rightarrow -9 = a$. The student could have then substituted the value of a into the function $y = a(x - 1)^2 + 46$, resulting in $y = -9(x - 1)^2 + 46$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely subtracted 10 from 46 instead of subtracting 46 from 10 when solving for a, resulting in $36 = 4a$ or $9 = a$. Then the student likely identified the coordinates of the given point as the values of h and k, resulting in $y = 9(x - 3)^2 + 10$. The student needs to focus on understanding how to write quadratic functions in vertex form.
	Option B is incorrect	The student likely subtracted 10 from 46 instead of subtracting 46 from 10 when solving for a, resulting in $36 = 4a$ or $9 = a$. The student likely then substituted the value of a into the function $y = a(x - 1)^2 + 46$, resulting in $y = 9(x - 1)^2 + 46$. The student needs to focus on understanding how to write quadratic functions in vertex form.
	Option C is incorrect	The student likely identified the coordinates of the given point as the values of h and k, resulting in $y = -9(x - 3)^2 + 10$. The student needs to focus on understanding how to write quadratic functions in vertex form.

Item #	Rationale	
26	Option B is correct	To determine which function (relationship where each input has a single output) best models the data in the table, the student could have used a graphing calculator to generate the function using linear regression (a method of determining a linear function, $y = mx + b$, where m represents the slope and b represents the y-intercept). The function that best models the data is $f(x) = -41x + 337$, or $f(x) = 337 - 41x$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely correctly identified the slope of the linear function and used the first y-coordinate from the table, $y = 296$, as the value of b, the y-intercept. The student needs to focus on understanding how to use technology to generate the equation of a function when given data in a table or graph.
	Option C is incorrect	The student likely generated the function using only the last two ordered pairs from the table, (6, 89) and (7, 51). Substituting the two ordered pairs into the formula for the slope of a line, the student likely obtained $m = \frac{51-89}{7-6} = -38$. Next, the student likely substituted the coordinates (7, 51) and the slope $m = -38$ into $y = mx + b$ and solved for b, resulting in $51 = -38(7) + b \rightarrow 51 = -266 + b \rightarrow 317 = b$. Since $b = 317$ and $m = -38$, the student obtained the equation $f(x) = -38x + 317$, or $f(x) = 317 - 38x$. The student needs to focus on understanding how to use technology to generate the equation of a function when given data in a table or graph.
	Option D is incorrect	The student likely used only the last two ordered pairs from the table, (6, 89) and (7, 51), to calculate the slope of the line and then used the first y-coordinate from the table as the value of b, the y-intercept. The student needs to focus on understanding how to use technology to generate the equation of a function when given data in a table or graph.

Item #	Rationale	
27	Option D is correct	To determine what 1.029 represents in the function $w(t) = 270(1.029)^t$, the student should have recognized that in an exponential function $w(t) = ab^t$, a represents the initial value (starting value), b is the common factor (constant rate by which successive values increase or decrease), and t is the variable (symbol used to represent an unknown number). In this situation, the variable t represents the number of years. In $w(t) = 270(1.029)^t$, the student should have recognized that the initial number of whales is 270 since $a = 270$. The student should have also recognized that the number of whales are increasing at a rate of 2.9% per year since $b = 1.029$ and that 1.029 represents the growth factor of the number of whales since $1.029 > 1$.
	Option A is incorrect	The student likely interpreted $b = 1.029$ as the initial number of whales in the North Atlantic Ocean, instead of recognizing that $b = 1.029$ is a growth factor since $b > 1$ and that $a = 270$ is the initial value. The student needs to focus on interpreting the meaning of the values of a and b of an exponential function in the form $w(t) = ab^t$.
	Option B is incorrect	The student likely interpreted $b = 1.029$ as the decay factor of the number of whales in the North Atlantic Ocean, which indicates a decrease of 2.9% per year, instead of recognizing that $b = 1.029$ is a growth factor since $b > 1$. The student needs to focus on interpreting the meaning of the values of a and b of an exponential function in the form $w(t) = ab^t$.
	Option C is incorrect	The student likely interpreted $b = 1.029$ as the number of whales in the North Atlantic Ocean at the end of the first year, instead of recognizing that $b = 1.029$ is a growth factor since $b > 1$ and that the value of $w(t)$ when $t = 1$ is the number of whales at the end of the first year. The student needs to focus on interpreting the meaning of the values of a and b of an exponential function in the form $w(t) = ab^t$.

Item #	Rationale	
28	Option C is correct	To determine the slope (steepness of a straight line graphed on a coordinate grid) of the line, the student could have used the given ordered pairs and applied the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$. Substituting the *x*-values and *y*-values of (−2, –2) and (4, 2) into the slope formula, the student could have calculated $m = \frac{2-(-2)}{4-(-2)} = \frac{4}{6} = \frac{2}{3}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely calculated the slope as the change in the *y*-values divided by the change in the *x*-values but made a sign error. The student needs to focus on understanding how to use the formula for the slope of a line when given two ordered pairs.
	Option B is incorrect	The student likely calculated the slope as the change in the *x*-values divided by the change in the *y*-values, $m = \frac{x_2 - x_1}{y_2 - y_1} = \frac{4-(-2)}{2-(-2)} = \frac{6}{4} = \frac{3}{2}$. The student needs to focus on understanding how to use the formula for the slope of a line when given two ordered pairs.
	Option D is incorrect	The student likely calculated the slope as the change in the *x*-values divided by the change in the *y*-values and made a sign error. The student needs to focus on understanding how to use the formula for the slope of a line when given two ordered pairs.

Item #	Rationale	
29	Option B is correct	To determine the solution to the equation 5(2w + 4) = 4(2w + 9), the student could first have distributed (multiplied) the number in front of the parentheses to the terms inside the parentheses, resulting in 10w + 20 = 8w + 36. Next, the student could have subtracted 8w from both sides of the equation, resulting in 2w + 20 = 36. The student then could have subtracted 20 from both sides of the equation, resulting in 2w = 16. Finally, the student could have divided both sides of the equation by 2, resulting in w = 8. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely distributed only to the first terms in the parentheses, resulting in 10w + 4 = 8w + 9. Then, subtracting 8w and subtracting 4 from both sides of the equation, the student likely obtained 2w = 5. Finally, dividing both sides of the equation by 2, the student likely found that $w = \frac{5}{2}$. The student needs to focus on understanding how to apply the distributive property when solving equations.
	Option C is incorrect	The student likely added instead of subtracting when moving terms across the equal sign, resulting in 10w + 20 = 8w + 36 → 18w = 56. Dividing both sides of the equation by 18, the student likely found that $w = \frac{56}{18} = \frac{28}{9}$. The student needs to focus on understanding the arithmetic of solving equations.
	Option D is incorrect	The student likely used addition instead of multiplication when distributing and distributed only to the first terms in the parentheses, resulting in 7w + 4 = 6w + 9. Then, subtracting 6w and subtracting 4 from both sides of the equation, the student likely obtained w = 5. The student needs to focus on understanding how to apply the distributive property when solving equations.

Item #	Rationale	
30	Option D is correct	To determine the best estimate of the price of a discounted ticket for the baseball game, the student could have graphed the first equation and the second equation on the same coordinate plane and estimated the coordinates of the point where the two lines intersect (cross) given the graph of the first equation. The student then could have estimated that the two lines intersect at (13.95, 11.15). Since *y* represents the price of a discounted ticket in dollars, the student could have concluded that the price of a discounted ticket is $11.15. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely estimated the price of a standard ticket instead of estimating the price of a discounted ticket, resulting in $13.95. The student needs to focus on interpreting the point of intersection of two intersecting lines.
	Option B is incorrect	The student likely overestimated the price of a standard ticket instead of estimating a discounted ticket, resulting in $14.55. The student needs to focus on estimating the solution to a system of equations using the graphing method.
	Option C is incorrect	The student likely divided the total amount of ticket sales by the sum (answer when added) of the number of standard tickets sold and the number of discounted tickets sold, resulting in $\frac{2{,}649.34}{153+47} = \frac{2{,}649.34}{200} \approx 13.25$. The student needs to focus on estimating the solution to a system of equations using the graphing method.

Item #	Rationale	
31	Option A is correct	To determine the first four terms of the sequence $f(n) = \frac{1}{3}f(n-1)$, where *f*(1) = 27, the student could have substituted *n* = 2, *n* = 3, and *n* = 4 into the function to determine the second, third, and fourth terms of the sequence, respectively. Since *f*(1) = 27, the student should have concluded that the first term of the sequence is 27. Substituting *n* = 2 into the function, the student could have obtained $f(2) = \frac{1}{3}f(2-1) = \frac{1}{3}f(1) = \frac{1}{3}(27) = 9$, so the second term of the sequence is 9. Substituting *n* = 3 into the function, the student could have obtained $f(3) = \frac{1}{3}f(3-1) = \frac{1}{3}f(2) = \frac{1}{3}(9) = 3$, so the third term of the sequence is 3. Last, substituting *n* = 4 into the function, the student could have obtained $f(4) = \frac{1}{3}f(4-1) = \frac{1}{3}f(3) = \frac{1}{3}(3) = 1$, so the fourth term of the sequence is 1. The first four terms of the sequence are 27, 9, 3, 1. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely multiplied by 3 instead of multiplying by $\frac{1}{3}$ when evaluating the function for *n* = 2, *n* = 3, and *n* = 4, resulting in the terms 27, 81, 243, 729. The student needs to focus on understanding how to identify terms of a geometric sequence when the sequence is given in function form using a recursive process.
	Option C is incorrect	The student likely identified $\frac{1}{3}$ as the first term of the sequence and then added 27 to the numerator (top number in a fraction) for each additional term, resulting in the terms $\frac{1}{3}, \frac{28}{3}, \frac{55}{3}, \frac{82}{3}$. The student needs to focus on understanding how to identify terms of a geometric sequence when the sequence is given in function form using a recursive process.
	Option D is incorrect	The student likely identified $\frac{1}{3}$ as the first term of the sequence and then multiplied the denominator (bottom number in a fraction) by 27 for each additional term, resulting in the terms $\frac{1}{3}, \frac{1}{81}, \frac{1}{2{,}187}, \frac{1}{59{,}049}$. The student needs to focus on understanding how to identify terms of a geometric sequence when the sequence is given in function form using a recursive process.

Item #	Rationale	
32	Option B is correct	To determine the range (all possible *y*-values) of *g*, the student could have plotted the six ordered pairs presented in the table on a coordinate grid and analyzed the shape of the graph. The student could have plotted points at $\left(\frac{1}{2}, \frac{7}{4}\right)$, (1, 4), $\left(\frac{3}{2}, \frac{19}{4}\right)$, (2, 4), $\left(\frac{5}{2}, \frac{7}{4}\right)$, and (3, –2) on a coordinate grid and determined that the points of the graph represent a parabola (U-shaped graph). Since the graph of the parabola opens downward, the maximum value should be identified as $\frac{19}{4}$ because the vertex (high point of the curve) $\left(\frac{3}{2}, \frac{19}{4}\right)$ is the same distance horizontally from the points (1, 4) and (2, 4), which means the vertex must be halfway between the two points. Therefore, the range of function *g* is all real numbers less than or equal to $\frac{19}{4}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified the *x*-coordinate, instead of the *y*-coordinate, of the vertex as the maximum value of the range. The student needs to focus on understanding how to represent the range of a quadratic function from a table of values.
	Option C is incorrect	The student likely identified the *x*-coordinate, instead of the *y*-coordinate, of the vertex as the boundary for the range and did not recognize that the parabola opens downward. The student needs to focus on understanding how to represent the range of a quadratic function from a table of values.
	Option D is incorrect	The student likely identified the *y*-coordinate of the vertex as the boundary for the range but did not recognize that the parabola opens downward. The student needs to focus on understanding how to represent the range of a quadratic function from a table of values.

Item #	**Rationale**	
33	Option C is correct	To determine which expression is equivalent to $(2a + 5)(3a – 2)$, the student could have multiplied each term in the factor $(2a + 5)$ by each term in the factor $(3a – 2)$ and then combined like terms (terms that contain the same variables raised to the same powers or constant terms). The multiplication steps are $2a(3a – 2) + 5(3a – 2)$, resulting in $6a^2 – 4a + 15a – 10$. The student could have combined like terms to obtain $6a^2 + 11a – 10$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely multiplied each term in the factor $(2a + 5)$ by each term in the factor $(3a – 2)$ but determined the product of $2a$ and $3a$ to be $6a$ instead of $6a^2$. The student likely multiplied $2a(3a – 2) + 5(3a – 2)$ to get a result of $6a – 4a + 15a – 10$, and then combined like terms, resulting in $17a – 10$. The student needs to focus on understanding how to find the product of two binomials.
	Option B is incorrect	The student likely multiplied only the first terms and the last terms in the two factors, resulting in $2a(3a) + 5(–2)$, or $6a^2 – 10$. The student needs to focus on understanding how to find the product of two binomials.
	Option D is incorrect	The student likely did not apply the negative sign when distributing $(2a + 5)$ to the factor $(3a – 2)$, resulting in $6a^2 + 4a + 15a + 10$. The student likely then combined like terms to obtain $6a^2 + 19a + 10$. The student needs to focus on understanding how to find the product of two binomials.

Item #	Rationale	
34	Option D is correct	To determine the linear function that models the total cost, t, for a single order of c cartridges, the student could have used the slope-intercept form of a linear equation ($t = mc + b$, where m represents the slope of the line and b represents the value of the t-intercept). The student could have identified the slope and y-intercept from the situation. Since the printer ink cost is a constant rate, \$18.99 per cartridge, the student could have recognized that this represents the slope of the function, so $m = 18.99$. Since the shipping fee is a flat rate, \$7.95, no matter the number of cartridges purchased in a single order, the student could have recognized that this represents the initial value (when $c = 0$) or t-intercept of the function, so $b = 7.95$. Therefore, the linear function that models the total cost for a single order of cartridges is $t = 18.99c + 7.95$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely reversed the variables (symbols used to represent an unknown number) in the function and added the cost per cartridge and the shipping fee, resulting in $c = 26.94t$. The student needs to focus on understanding how to write linear functions given a description of a situation.
	Option B is incorrect	The student likely reversed the variables in the function, resulting in $c = 18.99t + 7.95$. The student needs to focus on understanding how to write linear functions given a description of a situation.
	Option C is incorrect	The student likely added the cost per cartridge and the shipping fee, resulting in $t = 26.94c$. The student needs to focus on understanding how to write linear functions given a description of a situation.

Item #	Rationale	
35	4, 4	To determine the correct value of the exponent for each term, the student could have applied the negative exponent property, $a^{-n} = \frac{1}{a^n}$, to the *y* in the denominator (bottom of a fraction), resulting in $x^6y^3 \div x^2y^{-1}$. Next, the student could have applied the quotient of powers property, $\frac{a^m}{a^n} = a^{m-n}$, to the factors containing *x* and *y*, resulting in $x^{6-2}y^{3-(-1)} = x^4y^4$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
36	Option C is correct	To determine the function that models the number of students participating in sports after x years, the student could have used an exponential function of the form $f(x) = ab^x$, where a is the initial value (starting value), b is the common factor (constant rate by which successive values increase or decrease), and x is the variable (symbol used to represent an unknown number). From the given information, the student could have determined that the initial number of students who participated in sports was 317, so $a = 317$. The student should have recognized that since the number of students who participate in sports increases, this situation represents exponential growth, with a growth factor of $b = 1 + 0.04$, or $b = 1.04$. Substituting $a = 317$ and $b = 1.04$ into the exponential function $f(x) = ab^x$, the student could have obtained $f(x) = 317(1.04)^x$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified the correct initial value, $a = 317$, but used the growth rate, 4%, as the growth factor, resulting in $f(x) = 317(4)^x$. The student needs to focus on understanding how to determine the common factor of an exponential function from the given information.
	Option B is incorrect	The student likely identified the growth rate, 4%, as a rate of change (constant rate of increase or decrease) and represented the situation with a linear function instead of an exponential function, resulting in $f(x) = 4x + 317$. The student needs to focus on understanding how to determine the initial value and common factor of an exponential function from the given information.
	Option D is incorrect	The student likely identified the growth factor, $b = 1.04$, as a constant rate of change and represented the situation with a linear function instead of an exponential function, resulting in $f(x) = 1.04x + 317$. The student needs to focus on understanding how to determine the initial value and common factor of an exponential function from the given information.

Item #	Rationale	
37	Option D is correct	To determine which system of equations (two or more equations containing the same set of variables [symbols used to represent unknown numbers]) represents the graph of the two lines, the student could write each equation in slope-intercept form ($y = mx + b$, where m is the slope and b is the y-intercept) and then convert each equation to standard form ($ax + by = c$ where a, b, and c are integers). To find the equation for line a, the student could have used the first two sets of values in the table and applied the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, resulting in $m = \frac{51-81}{-6-(-11)} = \frac{-30}{5} = -6$. Next, the student could have substituted one of the ordered pairs from the table, (4, –9), and the slope, $m = -6$, into $y = mx + b$ and solved for b, resulting in $-9 = -6(4) + b \rightarrow -9 = -24 + b \rightarrow 15 = b$. Since $b = 15$ and $m = -6$, the equation for line a in slope-intercept form is $y = -6x + 15$. To convert the equation from slope-intercept form to standard form, the student could have added $6x$ to both sides of the equation, resulting in $6x + y = 15$. To find the equation for line b, the student could have used the first two sets of values in the table and applied the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, resulting in $m = \frac{18-3}{-9-(-4)} = \frac{15}{-5} = -3$. Next, the student could have substituted one of the ordered pairs from the table, (1, –12), and the slope, $m = -3$, into $y = mx + b$ and solved for b, resulting in $-12 = -3(1) + b \rightarrow -12 = -3 + b \rightarrow -9 = b$. Since $b = -9$ and $m = -3$, the equation for line b in slope-intercept form is $y = -3x - 9$. To convert the equation from slope-intercept form to standard form, the student could have added $3x$ to both sides of the equation, resulting in $3x + y = -9$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified the slopes as positive instead of negative and multiplied the y-term and constant by the coefficient of the x-term in each equation, resulting in $6y = x + 90$ for line a and $3y = x - 27$ for line b. The student likely then converted the equations from slope-intercept form to standard form by subtracting the y-term and the constant value from both sides of the equations, obtaining $x - 6y = -90$ for line a and $x - 3y = 27$ for line b. The student needs to focus on understanding how to write a linear function in standard form when given a table.
	Option B is incorrect	The student likely multiplied the y-term and constant by the coefficient of the x-term in each equation, resulting in $6y = x + 90$ for line a and $3y = x - 27$ for line b. The student likely then converted the equations from slope-intercept form to standard form by adding the x- and y-terms on one side of the equations, obtaining $x + 6y = 90$ for line a

		and $x + 3y = –27$ for line *b*. The student needs to focus on understanding how to write a linear function in standard form when given a table.
	Option C is incorrect	The student likely identified the *y*-intercepts but identified the slopes as positive instead of negative before converting the equations into standard form, resulting in $y = 6x + 15$ for line *a* and $y = 3x – 9$ for line *b*. The student likely then converted the equations from slope-intercept form to standard form by subtracting the *y*-term and the constant value from both sides of the equation, obtaining $6x – y = –15$ for line *a* and $3x – y = 9$ for line *b*. The student needs to focus on understanding how to write a linear function in standard form when given a table.

Item #	Rationale	
38	3, –9	To determine the coordinates of the vertex of the graph of g, the student could have identified $f(x) = x^2$ as the quadratic parent function and recognized that the coordinates of the vertex of the graph of f are (0, 0). The student could have recognized that $f(x - 3)$ represents the vertex of the graph of f shifted 3 units to the right. Then the student could have recognized that –9 in $g(x) = f(x - 3) - 9$ represents the vertex of the graph of f shifted down 9 units. Thus, the coordinates of the vertex of the graph of g are (3, –9). This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
39	Option C is correct	To determine which expression is equivalent to $24gh - 12g^2 + 18g$, the student could have determined that $6g$ is the greatest common factor (largest factor [numbers multiplied together to produce another number] that the numbers share) of $24gh$, $12g^2$, and $18g$. Because $6g(4h) = 24gh$, $6g(2g) = 12g^2$, and $6g(3) = 18g$, the student could have factored out $6g$ from the expression, resulting in $6g(4h - 2g + 3)$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely recognized that $6g$ is the greatest common factor but did not factor out the 6 from the last two terms, resulting in $6g(4h - 12g + 18)$. The student needs to focus on understanding how to identify the greatest common factor of an expression.
	Option B is incorrect	The student likely recognized that $12g$ is the greatest common factor for the first two terms but did not factor out the 12 from the last two terms, resulting in $12g(2h - 12g + 18)$. The student needs to focus on understanding how to identify the greatest common factor of an expression.
	Option D is incorrect	The student likely recognized that $12g$ is the greatest common factor for the first two terms but divided the last term by $6g$, resulting in $12g(2h - g + 3)$. The student needs to focus on understanding how to identify the greatest common factor of an expression.

Item #	Rationale	
40	Option D is correct	To determine the cost per click on Website 1, the student could set up and solved a system of equations (two or more equations containing the same set of variables [symbols used to represent unknown numbers]). If *x* represents the cost per click on Website 1 and *y* represents the cost per click on Website 2, the student could have set up two equations: $15x + 29y = 94.15$ (15 clicks on Website 1 and 29 clicks on Website 2 on Monday for a total cost of $94.14) and $25x + 29y = 121.15$ (25 clicks on Website 1 and 29 clicks on Website 2 on Tuesday for a total cost of $121.15). Next, the student could have solved the system of equations using the elimination method. Subtracting the first equation from the second equation to eliminate the term containing *y*, the student could have obtained $10x = 27$. Dividing both sides of the equation by 10, the student could have obtained the result $x = 2.7$. Since *x* represents the cost per click on Website 1, the student could have concluded that the cost is $2.70. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely set up and solved the system of equations correctly but switched the values of *x* and *y*, concluding that the cost per click on Website 1 was $1.85 instead of $2.70. The student needs to focus on understanding what value each variable represents in terms of the situation when solving a system of equations.
	Option B is incorrect	The student likely found the sum of the number of clicks on Website 1, 15 + 25 = 40, and the sum of the total costs, 94.15 + 121.15 = 215.3, and then divided the sums, obtaining $\frac{215.3}{40} = 5.3825$. Last, the student likely rounded 5.3825 to 5.38. The student needs to focus on understanding how to write a system of equations from a verbal description.
	Option C is incorrect	The student likely found the sum of the numbers of clicks on Website 1 and Website 2, 15 + 25 + 29 + 29 = 98, and the sum of the total costs, 94.15 + 121.15 = 215.3, and then divided the sums, obtaining $\frac{215.3}{98} \approx 2.1969$. Last, the student likely rounded 2.1969 to 2.20. The student needs to focus on understanding how to write a system of equations from a verbal description.

Item #	Rationale	
41	Option A is correct	To determine the solutions to $k(x) = 0$, the student could have used the quadratic formula ($x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$, where a, b, and c are the coefficients of the quadratic equation $ax^2 + bx + c = 0$) to solve for x. The student could have recognized that $a = 1$, $b = 32$, and $c = 248$, since the quadratic equation is $x^2 + 32x + 248 = 0$. Next, the student could have substituted $a = 1$, $b = 32$, and $c = 248$ into the quadratic formula and evaluated, resulting in $x = \frac{-32 \pm \sqrt{32^2-4(1)(248)}}{2(1)} \rightarrow x = \frac{-32 \pm \sqrt{1{,}024-992}}{2} \rightarrow x = \frac{-32 \pm \sqrt{32}}{2} \rightarrow x = \frac{-32 \pm 4\sqrt{2}}{2} \rightarrow x = -16 \pm 2\sqrt{2}$. Therefore, the solutions to $k(x) = 0$ are $x = -16 + 2\sqrt{2}$ and $x = -16 - 2\sqrt{2}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely used the quadratic formula to solve for x but started the formula with b instead of $-b$ in the numerator (top number or expression in a fraction), resulting in $x = \frac{32 \pm \sqrt{32^2-4(1)(248)}}{2(1)} \rightarrow x = \frac{32 \pm \sqrt{1{,}024-992}}{2} \rightarrow x = \frac{32 \pm \sqrt{32}}{2} \rightarrow x = \frac{32 \pm 4\sqrt{2}}{2} \rightarrow x = 16 \pm 2\sqrt{2}$. The student needs to focus on understanding how to apply the quadratic formula when finding solutions to a quadratic equation.
	Option C is incorrect	The student likely used the quadratic formula to solve for x but started the formula with a instead of $2a$ in the denominator (bottom number or expression in a fraction), resulting in $x = \frac{-32 \pm \sqrt{32^2-4(1)(248)}}{1} \rightarrow x = \frac{-32 \pm \sqrt{1{,}024-992}}{1} \rightarrow x = \frac{-32 \pm \sqrt{32}}{1} \rightarrow x = \frac{-32 \pm 4\sqrt{2}}{1} \rightarrow x = -32 \pm 4\sqrt{2}$. The student needs to focus on understanding how to apply the quadratic formula when finding solutions to a quadratic equation.
	Option D is incorrect	The student likely used the quadratic formula to solve for x but started the formula with b instead of $-b$ in the numerator and with a instead of $2a$ in the denominator, resulting in $x = \frac{32 \pm \sqrt{32^2-4(1)(248)}}{1} \rightarrow x = \frac{32 \pm \sqrt{1{,}024-992}}{1} \rightarrow x = \frac{32 \pm \sqrt{32}}{1} \rightarrow x = \frac{32 \pm 4\sqrt{2}}{1} \rightarrow x = 32 \pm 4\sqrt{2}$. The student needs to focus on understanding how to apply the quadratic formula when finding solutions to a quadratic equation.

Item #	Rationale	
42	Option A is correct	To determine which statement is true about the graph that represents the relationship between the value of a device in dollars and the number of years since the device was purchased, the student could have modeled the exponential function in the form $y = ab^x$, where a is the initial value (starting value), b is the common factor (rate by which successive values increase or decrease), and x is the variable (symbol used to represent an unknown number) and then used a graphing calculator to generate the graph of the function. From the given information, the student could have determined that the initial value of the electronic device was \$650, so $a = 650$. The student should have recognized that since the value of the electronic device decreases by 30%, this situation represents exponential decay, with a decay factor of $b = 1 – 0.3$, or $b = 0.7$. Substituting $a = 650$ and $b = 0.7$ into the exponential function $y = ab^x$, the student could have obtained $y = 650(0.7)^x$. Next, the student could have used a graphing calculator to generate the graph of $y = 650(0.7)^x$. Since the graph is an exponential curve that extends infinitely to the left and the right and never crosses the x-axis (horizontal axis), the equation of asymptote (a line that a curve approaches) of the graph is $y = 0$. Next, the student could have recognized that the y-intercept (value where a graph crosses the y-axis) of the graph is 650. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely identified the initial value as the value of y when $x = 1$ instead of when $x = 0$, resulting in $a = 455$. Substituting $a = 455$ and $b = 0.7$ into the exponential function $y = ab^x$, the student likely obtained $y = 455(0.7)^x$. Next, the student likely recognized that the y-intercept of the graph is 455. The student needs to focus on understanding how to identify the key features of exponential functions.
	Option C is incorrect	The student likely confused horizontal with vertical when describing the asymptote of the graph of the function. The student needs to focus on understanding how to identify the key features of exponential functions.
	Option D is incorrect	The student likely interpreted the rate of decrease as the horizontal asymptote. The student needs to focus on understanding how to identify the key features of exponential functions.

Item #	Rationale	
43	solid boundary line with a slope of –1 and y-intercept 2; shaded half plane that does not include test point (0, 0)	To determine the solution set for the linear inequality $y \geq -x + 2$, the student should have recognized that the graph of the solution set of the inequality would have a boundary line that is solid because the "≥" symbol indicates that the solution set includes the boundary line. The student should have recognized that the y-intercept of the inequality is 2 and the slope is –1 and graphed the line. Next, the student could have used the test point (0, 0) to determine which half plane is included in the solution set. Substituting (0, 0) into $y \geq -x + 2$, the student could have obtained $0 \geq 0 + 2$, or $0 \geq 2$. Since that is a false statement, the student could have then concluded that the solution set of the inequality is the half plane that does not contain (0, 0) and shaded that region. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.

Item #	Rationale	
44	Option C is correct	To determine the equation that best represents the line that passes through point *P* and is parallel (lines that do not intersect [cross] and are always the same distance from each other) to line *m*, the student could have first chosen two points from the graph of line *m* and calculated the slope (steepness of a straight line when graphed on a coordinate grid, represented by $m = \frac{y_2 - y_1}{x_2 - x_1}$). The student could have substituted the *x*- and *y*-coordinates of (0, –3) and (2, 0) from the graph of line *m* into the slope formula, resulting in $m = \frac{0-(-3)}{2-0} = \frac{3}{2}$. Since parallel lines have the same slope, the student should have concluded that the line passing through point *P* has a slope of $\frac{3}{2}$. Next, the student could have substituted the *x*- and *y*-coordinates of point *P*, (–2, 2), and $m = \frac{3}{2}$ into *y* = *mx* + *b* and solved for *b*, resulting in $2 = \frac{3}{2}(-2) + b$, or *b* = 5. Since *b* = 5 and $m = \frac{3}{2}$, the equation of the line that passes through point *P* and is parallel to line *m* is $y = \frac{3}{2}x + 5$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified the correct slope for both lines but switched the *x*- and *y*-coordinates of point *P* when substituting into *y* = *mx* + *b*, resulting in $-2 = \frac{3}{2}(2) + b$, or *b* = –5. Since *b* = –5 and $m = \frac{3}{2}$, the student likely obtained the equation $y = \frac{3}{2}x - 5$. The student needs to focus on understanding how to determine the *y*-intercept of a line that is parallel to a given line.
	Option B is incorrect	The student likely used the slope of the line that passes through point *P* and is perpendicular to line *m*, which is $-\frac{2}{3}$. Next, the student likely substituted the *x*- and *y*-coordinates of point *P*, (–2, 2), and $m = -\frac{2}{3}$ into *y* = *mx* + *b* and solved for *b*, resulting in $2 = -\frac{2}{3}(-2) + b$, or $b = \frac{2}{3}$. Since $b = \frac{2}{3}$ and $m = -\frac{2}{3}$, the student likely obtained the equation $y = -\frac{2}{3}x + \frac{2}{3}$. The student needs to focus on understanding how to determine the slope of a line that is parallel to a given line.
	Option C is incorrect	The student likely used the slope of the line that passes through point *P* and is perpendicular to line *m* and switched the *x*- and *y*-coordinates of point *P* when substituting into *y* = *mx* + *b*, resulting in $-2 = -\frac{2}{3}(2) + b$, or $b = -\frac{2}{3}$. Since $b = -\frac{2}{3}$ and $m = -\frac{2}{3}$, the student likely obtained the equation $y = -\frac{2}{3}x - \frac{2}{3}$. The student needs to focus on understanding how to determine the slope and *y*-intercept of a line that is parallel to a given line.

Item #	Rationale	
45	Option A is correct	To determine which equation is equivalent to $S = Ph + 2B$ when solved for B, the student could have first subtracted Ph from both sides of the equation, resulting in $S - Ph = 2B$. Next, the student could have divided both sides of the equation by 2, resulting in $B = \frac{S-Ph}{2}$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely divided both sides of the equation by Ph and then multiplied both sides of the equation by 2, resulting in $B = \frac{2S}{Ph}$. The student needs to focus on understanding the arithmetic of solving literal equations.
	Option C is incorrect	The student likely multiplied both sides of the equation by Ph instead of subtracting, resulting in $B = \frac{SPh}{2}$. The student needs to focus on understanding the arithmetic of solving literal equations.
	Option D is incorrect	The student likely subtracted 2 from both sides of the equation and then divided both sides of the equation by Ph, resulting in $B = \frac{S-2}{Ph}$. The student needs to focus on understanding the arithmetic of solving literal equations.

Item #	Rationale	
46	Option B is correct	To determine which graph could represent the part of a linear function (a function representing a straight line) given $x > 5$ and $y < 2$, the student could have identified the graph containing an open circle at the point with coordinates (5, 2) and a partial line that continues down and to the right infinitely (as represented by the arrow) since $y < 2$ and $x > 5$. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely interpreted $x > 5$ as meaning x is less than 5 and $y < 2$ as meaning y is greater than 2, resulting in a graph that contains an open circle at the point with coordinates (5, 2) and a partial line that continues up and to the left infinitely. The student needs to focus on understanding how to identify the domain and range of a linear function from a graph.
	Option C is incorrect	The student likely interpreted $x > 5$ as meaning x is less than 5, resulting in a graph that contains an open circle at the point with coordinates (5, 2) and a partial line that continues down and to the left infinitely. The student needs to focus on understanding how to identify the domain and range of a linear function from a graph.
	Option D is incorrect	The student likely interpreted $y < 2$ as meaning y is greater than 2, resulting in a graph that contains an open circle at the point with coordinates (5, 2) and a partial line that continues up and to the right infinitely. The student needs to focus on understanding how to identify the domain and range of a linear function from a graph.

Item #	Rationale	
47	Option B is correct	To determine the value of $g(20)$, the student should have substituted 20 for x in the function (relationship where each input value has a single output value) and then simplified the function, resulting in $g(20) = 6(2(20) + 7) = 6(40 + 7) = 6(47) = 282$.
	Option A is incorrect	The student likely added 6 to $2x$ before evaluating the function, obtaining $8x + 7$. The student then likely substituted $x = 20$ into the function, resulting in $g(20) = 8(20) + 7 = 160 + 7 = 167$. The student needs to focus on understanding how to apply the order of operations when simplifying a numeric expression.
	Option C is incorrect	The student likely added 20 and 7 before multiplying 20 by 2, resulting in $6(2(20 + 7)) = 6(2(27)) = 6(54) = 324$. The student needs to focus on understanding how to apply the order of operations when simplifying a numeric expression.
	Option D is incorrect	The student likely distributed (multiplied) the factor 6 to $2x$ but not to 7, obtaining $12x + 7$. The student then likely substituted $x = 20$ into the function, resulting in $g(20) = 12(20) + 7 = 240 + 7 = 247$. The student needs to focus on understanding how to apply the order of operations when simplifying a numeric expression.

Item #	Rationale	
48	Option C is correct	To determine the *x*-intercept (value where a graph crosses the *x*-axis) and *y*-intercept (value where a graph crosses the *y*-axis) of the line, the student could have determined that the graph of the linear function intersects (crosses) the *x*-axis when *x* = –2, so the *x*-intercept is (–2, 0). Next, the student could have determined that the graph of the linear function intersects the *y*-axis when *y* = 8, so the *y*-intercept is (0, 8). This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely switched the intercepts. The student needs to focus on understanding how to identify the intercepts of a linear function when given a graph.
	Option B is incorrect	The student likely chose the correct value for the *x*-intercept but used the slope (steepness of a straight line when graphed on a coordinate grid, represented by $m = \frac{y_2 - y_1}{x_2 - x_1}$) of the line as the *y*-intercept. The student needs to focus on understanding how to identify the intercepts of a linear function when given a graph.
	Option D is incorrect	The student likely chose the correct value for the *y*-intercept but used the slope of the line as the *x*-intercept. The student needs to focus on understanding how to identify the intercepts of a linear function when given a graph.

Item #	Rationale	
49	Option C is correct	To determine the values that best represent the zeros (input values, *x*, that produce an output value, *y*, of zero) of the function, the student could have identified the *x*-values where the graph crosses the *x*-axis (horizontal axis), which are –1 and 3. Therefore, the zeros of the function are *x* = –1 and *x* = 3. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option D is correct	To determine the values that best represent the zeros of the function, the student could have identified the *x*-values where the graph crosses the *x*-axis, which are –1 and 3. Therefore, the zeros of the function are *x* = –1 and *x* = 3. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified the *x*-coordinate of the vertex (high or low point of the curve) as a zero of the function, resulting in *x* = 1. The student needs to focus on understanding how to identify the key features of a quadratic function when given a graph of the function.
	Option B is incorrect	The student likely identified the *y*-coordinate of the vertex as a zero of the function, resulting in *x* = –4. The student needs to focus on understanding how to identify the key features of a quadratic function when given a graph of the function.
	Option E is incorrect	The student likely identified the *x*-coordinate of the *y*-intercept (value where a graph crosses the *y*-axis) as a zero of the function, resulting in *x* = 0. The student needs to focus on understanding how to identify the key features of a quadratic function when given a graph of the function.
	Option F is incorrect	The student likely identified the *y*-coordinate of the *y*-intercept as a zero of the function, resulting in *x* = –3. The student needs to focus on understanding how to identify the key features of a quadratic function when given a graph of the function.

Item #	Rationale	
50	Option C is correct	To determine the rate of change (constant rate of increase or decrease) of height off the ground with respect to the number of steps, the student could have chosen two points from the table and calculated the rate of change. The student could have used the first two sets of values in the table and applied the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, resulting in $m = \frac{35-21}{5-3} = \frac{14}{2} = 7$. Therefore, the rate of change is 7 inches per step. This is an efficient way to solve the problem; however, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely calculated the change in *y* but did not divide by the change in *x*, resulting in 14 inches per step. The student needs to focus on understanding that the rate of change of a linear relationship is equal to the change in the values of the dependent variable divided by the corresponding change in the values of the independent variable.
	Option B is incorrect	The student likely calculated the change in *x* over the change in *y*, resulting in $\frac{1}{7}$ inch per step. The student needs to focus on understanding that the rate of change of a linear relationship is equal to the change in the values of the dependent variable divided by the corresponding change in the values of the independent variable.
	Option D is incorrect	The student likely calculated the change in *x* over the change in *y* and used 1 as the change in *x*, resulting in $\frac{1}{14}$ inch per step. The student needs to focus on understanding that the rate of change of a linear relationship is equal to the change in the values of the dependent variable divided by the corresponding change in the values of the independent variable.